Method of Test for
DETERMINATION OF PERCENTAGE OF CRUSHED PARTICLES FOR COARSE AGGREGATES
DOTD Designation: TR 306M/306-97

I. Scope

A. This method is intended to determine the percentage of single face or double face crushed particles for coarse aggregate in stockpiles or in asphaltic mixture.

B. Reference Documents:
1. DOTD TR 108 - Splitting and Quartering Samples.
2. DOTD TR 307 - Bitumen Content of Paving Mixtures by Reflux Extractor.
3. DOTD TR 308 - Bitumen Content of Paving Mixtures by Centrifuge.
4. DOTD TR 323 - Asphalt Content of Asphaltic Mixtures by the Ignition Method.
5. DOTD TR 309 - Mechanical Analysis of Extracted Aggregate.
6. AASHTO M 92 - Wire-Cloth Sieves for Testing Purposes.
7. AASHTO T30 - Mechanical Analysis of Extracted Aggregate.

II. Apparatus

A. **Balance** - minimum 2000 g capacity, readable to 0.1 g.

B. **Sieve** - 4.75 mm (No. 4) woven wire mesh sieve conforming to AASHTO M 92.

C. **Oven** - capable of maintaining a uniform temperature of 110±5°C (230±9°F).

D. **Pans** - sufficient to hold sample without spilling, and large enough to spread the material for rapid drying.

E. **Thermal Gloves, Apron, Container Holder, Eye Protection** - for use when handling hot material and equipment.

F. **Forms** - Aggregate Test Report, Asphaltic Concrete Plant Report (Figure 1), Asphaltic Concrete Verification Report, or other appropriate forms.

III. Health Precautions

Proper precautions are to be taken whenever hot materials or equipment must be handled. Use container holder or thermal gloves while handling hot containers. Wear eye protection while stirring and weighing the heated materials due to possible shattering of particles. Dry contaminated materials under a vent to prevent exposure to fumes.

IV. Sample

A. Stockpiles: One full sample sack of crushed aggregate.
1. Obtain a representative test sample of approximately 1200 g in accordance with DOTD TR 108.
2. Dry and separate the test sample into two portions by means of a 4.75 mm (No. 4) sieve. Wash the aggregate retained on the 4.75 mm (No. 4) sieve and dry to facilitate the inspection of particles.
3. The test specimen is that portion of the test sample retained on the 4.75 mm (No.4) sieve.

B. Asphaltic concrete loose mixture sample.
1. Extract the entire aggregate portion from the loose mixture sample in accordance with DOTD TR 307, DOTD TR 308 or DOTD TR 323.
2. Obtain the test specimen by retaining all of the plus 4.75 mm (No. 4) aggregate from performing the extracted aggregate gradation analysis in accordance with DOTD TR 309 or AASHTO T30.

V. Procedure

A. Determine mass of test specimen and record as Mass of Plus 4.75 mm (No. 4) on the worksheet.

B. Spread the test specimen on a clean surface using a large enough area so that individual particles may be inspected closely.

C. Separate the crushed particles from the uncrushed and determine the percent crushed aggregate base on a single face crushed or a double face crushed.

1. A single face crushed particle is one which has one or more fractured faces, and the whole of the fractured face or faces is at least 25 % of the total surface area of the particle as determined by visual inspection.
2. A double face crushed particle is one which has two or more fractured faces and the whole of the fractured faces is at least 50% of the total surface area of the particle as determined by visual inspection.

D. Determine mass of the crushed aggregate, and record the mass as "Mass of Crushed Aggregate" on the worksheet.

VI. Calculations

Calculate the % Crushed to the nearest whole percent in accordance with the following formula:

$$\% \text{ Crushed} = \frac{\text{Mass of Crushed Aggr.}}{\text{Mass of Plus 4.75 mm (No. 4) Aggr.}} \times 100$$

where:

% Crushed = % of crushed aggregate single face or double face in test specimen

Mass of Crushed Aggregate = mass of crushed aggregate in test specimen portion

Mass of Plus No. 4 Aggregate = mass of test specimen

100 = constant

example:

Mass of Crushed Aggregate = 477.9 g
Mass of Plus No. 4 Aggregate = 508.7 g

$$\% \text{ Double Face Crushed} = \frac{477.9}{508.7} \times 100$$

$$= 0.9394 \times 100$$

$$= 93.94$$

% Crushed = 94

VII. Report

A. Report the percent crushed aggregate single face or double face to the nearest whole number.

B. Report percent crushed for stockpile samples on the Aggregate Test Report Form.

C. Report percent crushed for asphaltic loose mixture on Asphaltic Concrete Plant Report Form or Asphaltic Concrete Verification Report Form.

VIII. Normal Test Reporting Time

The normal test reporting time is 4 hours.

MATT MENU SELECTION – 04

DOTD 22-3085 (5/97)
METRIC / ENGLISH

ASPHALTIC CONCRETE PLANT REPORT

Metric/English E (M / E) *Located on MATT Menu*

Proj.No. 826-04-0010 Plant H213 Mix Code 20

Proj.No. Seq. No. 15 Lot No. 108

Proj.No. Purp. Code 3 N.Gradations 4

Proj.No. TSR, % 98 Ten.Str.Control 1.12

Proj.No. Lot Size 1000 Act.Lot, Mg (Tons) 1012

Start Date 06-17-97 Weather:

End Date 06-17-97 Temp.:High 90 °C (°F) Low 73 °C (°F)

% AC BY IGNITION METHOD (DOTD TR 323)			TEST 1	TEST 2	TEST 3
Mass of Mix, Trays & Pan	M_T				
Mass of Trays & Pan	M_P				
Total Mass of Mix	M_S	$M_T - M_P$			
Correction Factor for Mix, %	CF				
Moisture Correction, % (TR 318)	MC				
Mass Loss, %	M_L				
AC Content, %	AC	(M_L - CF) or (M_L - CF - MC)			
Dry Total Mass of Aggregate	M				
Dry Mass After Wash, (TR 309)	X				
Decantation Loss	Y	M - X			
Accumulated Total	Z				
% Difference		M - Z/M (100)			
Sample Taken/ Mg (tons) Accum					

MARSHALL TEST PROPERTIES (DOTD TR 304 & TR 308)			1	2	3	4	AVERAGE
Mass in Air	A						
Mass in Water	B						
Difference	C	A - B					
Specific Gravity	D	A/C					
Theo Gravity	E	100 / L					
% Theo Gravity	F	D x 100 / E					
Density - Lb/Cu Ft	G	D x 62.4					
% Voids	H	100 - F					
% AC by Volume	I	DM / K for AC					
% VMA		H + I					
% VFA		I / H + I (100)					
Dial Reading							
Stability, kN (lb)		From Chart					
Thickness, mm (in)							
Correction Factor							
Corrected Stability, kN (lb)							
Flow 0.1 (1/100)							
Sam. Taken		Mg (Tons) Accum.					
Temp of Mix °C (°F)							

DISCHARGE TEMPERATURE		
JMF LIMITS –	Mg (Tons) ACC.	ACT. TEMP.
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

	TEST 1	TEST 2
% MC (AGG)		
% AC Met/Sc		
% Anti-Strip		
% Lime		

THEORETICAL GRAVITY AND BATCH WEIGHTS (DOTD TR 304)

MATERIAL		SOURCE	% BIN PROP (H)	% (J) M (100 - N) / 100	SPEC. GRAV. (K)	SOLID VOL J / K	BATCH MASS LB
Bin No. 1							
Bin No. 2							
Bin No. 3							
Asphalt	Grade			(N)			
TOTAL			100	100.0	TOTAL (L)		

PERCENT PAY

Stability

Gradation

Anti-Strip

GRADATION OF EXTRACTED AGGREGATE (DOTD TR 309) - % CRUSHED (DOTD TR 306)

SIEVE mm/µm	SIEVE in.	TEST NO. 1 MASS	TEST NO. 1 PERCENT	TEST NO. 1 % COARSER	TEST NO. 1 % PASSING	TEST NO. 1 DEV 1	TEST NO. 2 MASS	TEST NO. 2 PERCENT	TEST NO. 2 % COARSER	TEST NO. 2 % PASSING	TEST NO. 2 DEV 2	TEST NO. 3 MASS	TEST NO. 3 PERCENT	TEST NO. 3 % COARSER	TEST NO. 3 % PASSING	TEST NO. 3 DEV 3
63	2 1/2															
50	2															
37.5	1 1/2															
31.5	1 1/4															
25.0	1															
19.0	3/4															
12.5	1/2															
9.5	3/8															
4.75	No. 4															
2.00	No. 10															
425	No. 40															
180	No. 80															
75	No.200				•					•					•	
Passing 75 (200)			Mass Crushed		477.9			Mass Crushed					Mass Crushed			
Decant Loss (Y)			Mass +4.75 (+4)		508.7			Mass +4.75 (+4)					Mass +4.75 (+4)			
Accum Total (Z)			% Crushed		94			% Crushed					% Crushed			

AVERAGES

SIEVE mm/µm	SIEVE in.	AVERAGE	AVG DEV	JMF
63	2 1/2			
50	2			
37.5	1 1/2			
31.5	1 1/4			
25.0	1			
19.0	3/4			
12.5	1/2			
9.5	3/8			
4.75	No. 4			
2.00	No. 10			
425	No. 40			
180	No. 80			
75	No.200			
% AC				
% AC Mt/S				% AC
% Crushed				

Technician _____ Inspector _____ District Lab _____ Approved By: _____

Figure 1